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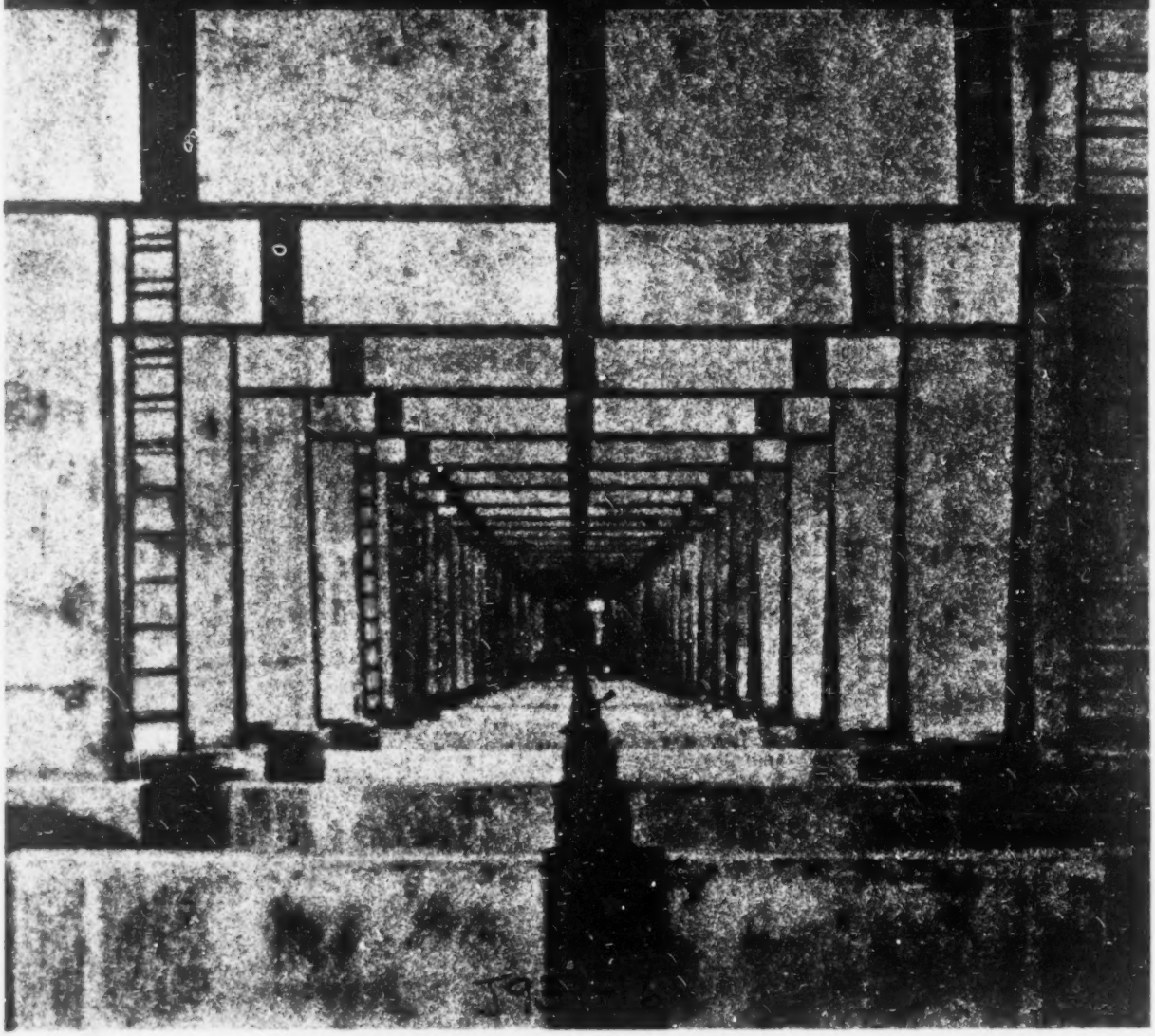
Assessing the Effectiveness Of Milestone Budgeting



A SPECIAL STUDY

PREFACE

The Congress is currently considering ways to improve the efficiency of acquiring weapons systems for the nation's defense. One alternative, endorsed by the President's Commission on Defense Management (Packard Commission), would approve multiple years of advanced funding for weapons systems, based on milestones that occur during the acquisition process. Last year, the Congress authorized the use of "milestone budgeting" and requested that the Department of Defense designate several programs to test its effectiveness.

In order to assist the Congress in its deliberations on milestone budgeting, the Senate Budget Committee requested that the Congressional Budget Office (CBO) examine its potential advantages and disadvantages and issues related to implementation. In accordance with CBO's mandate to provide objective analysis, the report makes no recommendations.

G. Wayne Glass of CBO's National Security Division prepared the study, under the general supervision of Robert F. Hale and John D. Mayer, Jr. The author thanks Col. James J. Lindenfelser (USAF, ret.), formerly of the professional staff of the Packard Commission, for his comments on an earlier draft. (External reviewers bear no responsibility for the final product, which rests solely with CBO.) The author also gratefully acknowledges the contributions of Roy Meyers of CBO's Budget Analysis Division and William Kostak of the National Security Division. Patricia H. Johnston edited the manuscript and Rebecca J. Kees prepared it for publication.

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July 1987

NOTE

Unless otherwise indicated, all years used in this report are fiscal years.

ASSESSING THE EFFECTIVENESS OF MILESTONE BUDGETING

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SUMMARY

In 1986, the Congress enacted legislation that directed the Secretary of Defense to designate several weapons programs for Congressional consideration as possible candidates for "milestone budgeting." Milestone budgeting is a new method of funding under study by the Congress to replace, at least partially, the annual budget process for the research and development (R&D) and procurement of weapons systems. Under the legislation that authorized the milestone approach, the Congress could approve up to five years of program funding in advance. Milestone budgets would be based on program estimates established at the development and production milestones that occur during the weapons acquisition process. (See box for a description of milestones.) Unless problems arose, the Congress would not again review program authorization--and perhaps appropriation--until the next milestone or until five years had elapsed.

The primary purpose of the legislation is to increase program stability, which, in turn, would enhance program management. Milestone budgeting would also reduce program costs and workloads on reviewers in Congress and the Department of Defense (DoD). Recently endorsed by the Packard Commission on Defense Management, the milestone budgeting concept has also been supported in a number of other major reviews of the defense acquisition process, including the Report of the Commission on Government Procurement (1972), the Defense Resource Management Study (1979), and the Carlucci Initiatives (1981). In order to assist the Congress in its deliberations concerning further implementation of milestone budgeting, this study examines its potential advantages and disadvantages, and discusses issues related to formulating an implementation plan.

POTENTIAL ADVANTAGES AND DISADVANTAGES OF MILESTONE BUDGETING

Generally, milestone budgeting could alter the incentives motivating defense program managers, causing them to focus more on longer-term issues and project management rather than each year's funding requests. Milestone budgeting could also offer more specific advantages--and some problems--as discussed below.

ACQUISITION MILESTONES AND PHASES

Milestone 0--Justification for Major System New Start (JMSNS)

A review by the Defense Resources Board (DRB) of the need for a new major weapon system proposed by the services or the staff of the Office of the Secretary of Defense.

Concept Exploration Phase

Follows Milestone 0. Program office identifies alternative approaches to fulfilling mission need stated in JMSNS. Establishes initial technical specifications and cost and schedule estimates. Develops test and evaluation plan and identifies critical technical issues.

Milestone I--Concept Validation

Defense Acquisition Board (DAB) reviews and validates conceptual approach proposed by service to meet requirement. DAB establishes planning baseline cost, schedule, and performance thresholds to be met at Milestone II. DAB reviews and validates test and evaluation (T&E) and logistics and support plans and acquisition strategy.

Demonstration and Validation Phase

Follows Milestone I. Program office directs preliminary engineering and design work and analyzes cost, performance, and schedule trade-off options. Contractor develops prototypes to demonstrate feasibility of system, subsystems, components, and test and support equipment. Principal areas of risk and alternative solutions identified. Initial design reviews and development testing conducted.

Milestone II--Full-Scale Development Milestone

Defense Acquisition Board reviews results of the Demonstration and Validation Phase and recommends program go-ahead when system feasibility demonstrated. Program cost, schedule, performance thresholds are updated and serve as development baseline for reports to the Congress. Test and Evaluation Master Plan (TEMP), acquisition business strategy, and support and logistics plans reviewed and updated.

Full-Scale Development Phase

Follows Milestone II. System is fully developed, engineered, and fabricated. Test items are built. Development and operational testing are conducted on system, subsystems, and components. Engineering and design changes occur and preparations for transition to production made.

Milestone III--Production Approval

Defense Acquisition Board reviews results of full-scale development phase and recommends approval to enter production phase. (Decision may be delegated to service secretaries if Milestone II baseline thresholds not breached.) Milestone may be separated into initial (IIIA) and full-rate (IIIB) production milestones. Milestone IIIA may be elected to provide test items and reduce technical manufacturing risks. Operational testing must be complete and certified acceptable to the Congress by the Secretary of Defense before entering full-rate production.

Program Stability

Historical program and budget data indicate that developing and purchasing weapons systems is a very unstable business in which program plans are often not fulfilled. For example, a majority of major weapons programs, reported by DoD to the Congress in the *Selected Acquisition Reports* (SARs), have not met planned schedules. Funding for both development and production programs has also been unstable. According to budget data from fiscal years 1982 through 1986, funding authorized by the Congress for development programs has differed by more than 10 percent from DoD's plan of the previous year for more than 80 percent of the time. For 66 percent of the time, production quantities were changed by more than 5 percent from the previous year's plan. Many of these changes appear related to budget constraints. According to the SARs, about 63 percent of program costs in excess of baseline estimates resulted from changes in production quantities, which were often reduced because of altered budgets. Technical or engineering changes accounted for only 16.6 percent of the cost increases.

Would milestone budgeting improve program stability? It need not, since the Congress could always revisit programs before their next milestone and enact changes. But experience with another form of long-term budgeting--multiyear contracts--suggests that the Congress usually does not make major changes in programs approved for long-term contracts. The long-term funding under milestone budgeting might also inspire legislative continuity.

Savings

Milestone budgeting could achieve significant savings as a result of increased program stability. The greatest potential for savings lies in avoiding added costs associated with program stretchouts. The Congressional Budget Office (CBO) has estimated that production stretchouts between 1981 and 1984 added an average of $4 billion (in budget authority) each year to total acquisition costs. The results of multiyear contracts are again an indicator of possible milestone effects--in this case potential savings. A review of 46 multiyear contracts suggests savings of about 12 percent relative to the probable costs of buying the same number of weapons using annual contracts. Because programs approved for multiyear contracts are chosen partially because they are already stable, comparable savings might not occur if milestone budgeting were applied widely. They do, however, suggest the potential for the degree of cost reduction that could be obtained through the use of milestone budgeting.

Workload Reduction

Milestone budgeting could potentially reduce the budget review workload both for DoD and the Congress. Under this approach, program reviews would not occur every year but rather at milestones, at designated intervals, or at the breaching of a program threshold. The extent to which the review workload could be lowered would depend primarily on the design of the milestone budgeting system. If, for example, budgets for all programs in the SAR reports were structured to last until the next milestone (but no more than five years), then the number of budget reviews could be reduced by as much as 75 percent over a 10-year period according to an analysis of data for the 1976-1986 period. Workload reduction would also be influenced by other factors, such as whether milestone funding is both authorized and appropriated by the Congress or just authorized (an issue discussed more fully below). In addition to the possible reduction in the quantity of the budget review workload, milestone budgeting could improve the quality of the reviews as fewer reviews could permit more detailed assessment of each program.

Problems of Flexibility and Variability

Milestone budgeting could also cause some problems. Depending on the number of programs included, the milestone approach could lead to the exemption of a significant portion of the defense budget from review each year. The Congress, therefore, would have less flexibility to adjust individual programs or to reallocate significant portions of the budget. If applied to all SAR programs over the 1976-1986 period, for example, milestone budgeting based on five years' funding would have exempted about 15 percent of R&D funds and 27 percent of procurement funds from annual reviews.

Milestone budgeting could increase program instability for nonmilestone programs. If the Congress committed a certain portion of the defense budget to milestone programs, and if the total DoD budget authorized by the Congress were reduced below planned levels, all program adjustments required to meet budget constraints would be borne by nonmilestone programs. The Congress could, of course, choose to adjust funding already provided for milestone programs, but this would negate the benefits of stability.

Milestone budgeting could also increase variation in the defense budget. Section 906 of the 1987 Defense Authorization Act states that the Congress shall authorize funding for milestone programs "in a *single*

amount sufficient to carry out that (acquisition) stage, but not for a period in excess of five years...." (Emphasis added.) If the Congress authorized and appropriated such funding in a lump sum, a significant degree of variability in the defense budget could ensue if several large programs reached their milestones in the same budget year. For example, an analysis based on historical budget data and assuming milestone budgeting for all SAR programs indicates that lump-sum funding could have required a 25 percent increase in the total DoD budget in 1982.

On the other hand, milestone budgeting could be managed in ways that would avoid, or at least minimize these problems. The Congress could eschew lump-sum funding by approving needed funds for several years but allocating them by year. For its part, DoD could prevent several large programs from arriving at their milestones in the same year. Programs subject to milestone budgeting could be limited to a number that would not produce unacceptable levels of budget inflexibility or variability.

ISSUES IN FORMULATING A MILESTONE BUDGETING PLAN

The 1987 Defense Authorization Act initiated the use of milestone budgeting for a limited number of programs that were labeled Defense Enterprise Programs (DEPs). The desirability and direction of expanding its use will be influenced by the costs and benefits derived from the DEP programs. In anticipation of the results of this test, the Congress may desire to develop a plan to proceed with broader implementation of milestone budgeting. If so, a number of issues merit consideration.

Number of Programs

One key issue is the number of programs to be included under milestone budgeting. By restricting the use of milestone budgeting to a few programs, the potential savings generated by improved program stability would be limited. The flexibility of the Congress to make budget adjustments, however, would be largely unaffected. On the other hand, while universal application of milestone budgeting could save greater sums, it would probably also exact a cost in budget flexibility.

One specific alternative would limit milestone budgeting to some or all major programs--defined as programs reported in the SAR reports. Major programs account for about half the procurement budget and 15 percent of the R&D budget. The Congress might also wish to include selected

smaller programs. Since there are some 1,800 of these programs, including all of them could create administrative difficulties.

Milestones to Be Included

A second issue concerns the acquisition milestones to which milestone budgeting would apply. The current legislation permits milestone authorization for programs either entering or in full-scale development (Milestone II) or in full-rate production (Milestone IIIB). Other acquisition milestones could be covered, including initial program approval (Milestone 0); concept validation (Milestone I); and initial, low-rate production (Milestone IIIA).

The decision of which milestones to include in the budgeting scheme for each program should consider the degree of risk in meeting the planned requirements. If a program is unable to meet the cost, schedule, and performance plans established at a milestone, reviews of program plans between milestones might be necessary. These "revisits," however, would defeat the purpose of milestone budgeting and could also complicate the budget management process. The risk of breaching program plans generally decreases from early acquisition stages, when relatively little about a system may be known or tested, to the latter stages, when items are produced and become operational. Risk also varies according to individual programs, which suggests that milestone budgeting might best be considered on a program-by-program basis without presetting limits on which milestones should be included.

Duration of Milestone Funding

The risk that a planned threshold could be breached would also be affected by the length of time for which milestone funding would be provided. In general, the longer the period of funding, the greater the risk would be. Other factors, however, might also have an effect. Programs with low technical risk, for example, might be appropriate for longer periods of milestone funding. Again, these factors suggest that the decision should be made on a case-by-case basis.

Several choices of duration are available. The 1987 Authorization Act authorizes milestone funding sufficient to proceed to the next milestone, unless that period exceeds five years. The Congress could consider providing funds for a shorter period, such as two years, which would be compatible with the two-year budget cycle now being discussed (biennial budgeting), and

which would provide for greater budget flexibility than the five-year option. A two-year milestone funding period, however, might not provide the same degree of workload reduction and savings as a longer period.

Manner of Funding

The manner in which milestone funding is provided--whether lump sum or annual--is also an important issue. Suppose a program was expected to cost $3 billion--$1 billion in year one and $2 billion in year two (all in budget authority). The Congress could provide all $3 billion in a lump sum the first year, to be spent as needs dictate. Or the Congress could approve spending $3 billion but require that no more than $1 billion be obligated in year one and $2 billion in year two. Lump-sum funding would maximize managerial discretion and provide the greatest assurance that funds would be available; these benefits could increase chances for efficiencies and savings. The current test legislation calls for funding "in a single amount," which could permit lump-sum funding. But lump-sum funding could also generate variability in the defense budget if several large programs reached their milestones in the same budget year.

Authorization and Appropriation

One key decision in the design of a milestone budgeting plan concerns whether funds for milestone programs would be authorized only (which would set policy and permit funds to be spent but not make funds available) or both authorized and appropriated (which would set policy and provide funds). The armed services authorizing committees have proposed milestone budgeting; in the past they have been more inclined toward multiyear commitments of DoD funds than have the appropriations committees.

The greatest potential for ensuring program stability and reducing the budget review workload could be achieved if milestone funding were both authorized and appropriated at the same time. Benefits could still be achieved if milestone funding were only authorized, since such a statement by the Congress might increase the chances of full annual appropriations. But workloads would be reduced less, because preparations would continue to be required for the annual appropriation debate. Moreover, program adjustments during the appropriation process could reduce the stability sought by milestone budgeting. Considering historical practices, a significant risk exists that program instability would occur. A review of major R&D and procurement programs during the 1982-1987 periods indicates that appropri-

ated funds differed by greater than 10 percent from authorized amounts for more than 20 percent of the time.

FUTURE STEPS

The DoD has recently proposed three weapons systems for a test of milestone budgeting, and the Congress may approve them. Because those systems would take several years to reach their next milestone, this test will not be complete until the early 1990s. The Congress could continue approving a few programs each year for milestone budgeting, thereby expanding the test modestly while awaiting results.

If results suggest that milestone budgeting is desirable, the Congress will have to consider how to implement the process more fully. One gradual form of implementation would institute milestone budgeting only as new and appropriate programs reach applicable milestones. Under this form of transition, many years would be needed to implement milestone budgeting fully, but this approach would avoid the surge of milestone reviews that would occur if the process were applied to all existing programs simultaneously.

CHAPTER I

INTRODUCTION

In fiscal year 1987, the Department of Defense (DoD) will spend about $121 billion in budget authority for research, development, and procurement of weapons and their support systems. Before reaching the armed forces, each of these items will progress through many stages--from idea to development to production. 1/ Normally, each stage in the acquisition process requires more than one year to complete. For most weapon systems, however, DoD annually reviews the programs, seeks Congressional approval, and funds contracts to complete successive portions of work.

BACKGROUND

In April 1986, the President's Blue Ribbon Commission on Defense Management (the Packard Commission) proposed a major change to the budget process by which weapons are developed and acquired. The proposed change, called "milestone budgeting," recommends a new approach based on the stages, or milestones, that occur in the weapons acquisition process. The 1987 Defense Authorization Act required a limited test of this new budgeting technique under the title of "Defense Enterprise Programs."

Under milestone budgeting, DoD and the Congress would decide to fund a program at certain major milestones, and, unless problems developed, would not review the program again until the next milestone occurred or five years had passed, whichever came first. 2/ A decision could be made at each of four basic acquisition milestones (see box for description): 3/

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1. The terms "production" and "procurement" are sometimes used interchangeably. In this context, production refers to the phase in the acquisition process in which items are manufactured; procurement refers to the funding of production programs in the budget process.

2. While the Constitution limits appropriations for the Army to a maximum term of two years (article I, section 8, clause 12), over the years this provision has not applied to the purchase of military equipment. Consequently, the Constitution does not bar multiyear budgeting through practices such as milestone budgeting for defense procurement programs. For further discussion, see Louis Fisher, *Constitutional Conflicts Between Congress and the President* (Princeton, N.J.: Princeton University Press, 1985), pp. 318-23.

3. The Department of Defense is currently revising the acquisition milestone structure, but will retain the four milestones identified below.

ACQUISITION MILESTONES AND PHASES

Milestone 0--Justification for Major System New Start (JMSNS)

A review by the Defense Resources Board (DRB) of the need for a new major weapon system proposed by the services or the staff of the Office of the Secretary of Defense.

Concept Exploration Phase

Follows Milestone 0. Program office identifies alternative approaches to fulfilling mission need stated in JMSNS. Establishes initial technical specifications and cost and schedule estimates. Develops test and evaluation plan and identifies critical technical issues.

Milestone I--Concept Validation

Defense Acquisition Board (DAB) reviews and validates conceptual approach proposed by service to meet requirement. DAB establishes planning baseline cost, schedule, and performance thresholds to be met at Milestone II. DAB reviews and validates test and evaluation (T&E) and logistics and support plans and acquisition strategy.

Demonstration and Validation Phase

Follows Milestone I. Program office directs preliminary engineering and design work and analyzes cost, performance, and schedule trade-off options. Contractor develops prototypes to demonstrate feasibility of system, subsystems, components, and test and support equipment. Principal areas of risk and alternative solutions identified. Initial design reviews and development testing conducted.

Milestone II--Full-Scale Development Milestone

Defense Acquisition Board reviews results of the Demonstration and Validation Phase and recommends program go-ahead when system feasibility demonstrated. Program cost, schedule, performance thresholds are updated and serve as development baseline for reports to the Congress. Test and Evaluation Master Plan (TEMP), acquisition business strategy, and support and logistics plans reviewed and updated.

Full-Scale Development Phase

Follows Milestone II. System is fully developed, engineered, and fabricated. Test items are built. Development and operational testing are conducted on system, subsystems, and components. Engineering and design changes occur and preparations for transition to production made.

Milestone III--Production Approval

Defense Acquisition Board reviews results of full-scale development phase and recommends approval to enter production phase. (Decision may be delegated to service secretaries if Milestone II baseline thresholds not breached.) Milestone may be separated into initial (IIIA) and full-rate (IIIB) production milestones. Milestone IIIA may be elected to provide test items and reduce technical manufacturing risks. Operational testing must be complete and certified acceptable to the Congress by the Secretary of Defense before entering full-rate production.

- Milestone 0--Justification for a Major System New Start (JMSNS),
- Milestone I--Concept Demonstration and Validation,
- Milestone II--Full-Scale Engineering Development, and
- Milestone III--Production.

Major milestones normally occur at irregular intervals during the acquisition process, with each phase usually requiring several years or more to complete. Milestone budgeting would, therefore, reduce the frequency of reviews. According to proponents of this approach, fewer program reviews during the budgeting process would reduce mid-procurement changes in weapons programs, lower program costs, and decrease the workload for both the Congress and DoD. Improved program stability and lower costs are critical elements to ensuring overall affordability of defense programs, particularly during periods of constrained budget growth or real reductions.

In addition to providing advantages, however, milestone budgeting could raise some problems. These include increased year-to-year variation in budget totals and the potential need to reduce spending of funds already committed through milestone budgeting as a result of future budget constraints.

As the Congress considers milestone budgeting, it must make choices concerning a number of issues: how many and what type of systems would be covered, which milestones would be subject to review, how long a period would elapse between reviews, and what program problems might trigger a special review. The Congress must also decide whether milestone budgeting would apply only to authorization of the system (which would allow the program to proceed, but would not provide funds) or to both authorization and appropriation of funds.

OTHER SPECIAL BUDGETING TECHNIQUES

While this study focuses on milestone budgeting, this new budgeting technique should be studied in light of related approaches currently being considered or used by the Congress. For example, a two-year defense budget has been prepared by the Administration for fiscal years 1988 and 1989 and will be debated by the Congress this year. In addition, multiyear contract-

ing for major weapon programs has been in place for many years and has become a major means for increasing budgetary stability for production programs.

Two-Year Budgeting

At the request of the Congress, the Administration submitted a two-year defense budget request this year. The purpose is to provide greater stability to defense programs through Congressional budget approval that extends for more than one year. In certain respects, the preparation of a two-year budget does not represent a departure from past practices. For a number of years, DoD has annually submitted a budget request that has included the planned request for the following year. In previous years, however, the Congress has acted only on the request for the upcoming budget year, disregarding the planned budget request for future years. This year, however, the Congress plans to make decisions on the defense budget for both 1988 and 1989.

Unless the Congress chooses to defer action on the 1989 budget, the Administration will not submit another defense budget request until 1990. At issue is whether or not the Congress will decide both to authorize and to appropriate funds for a two-year period. Alternatively, the Congress could choose to authorize a program for a two-year period, but continue to appropriate funds on an annual basis. This alternative would probably require the Administration to submit a budget appropriation request for 1989 to supplement the current DoD budget request submission for 1988-1989.

Milestone budgeting could be consistent with a two-year budgeting cycle by scheduling program reviews every two years. The analysis in this study includes consideration of a two-year budget cycle and its possible effect on the variables affecting the potential costs and benefits of milestone budgeting.

Multiyear Contracting

Multiyear contracting is another approach to budgeting for major weapon programs that has been introduced in recent years to provide greater stability to defense acquisitions. In 1982, the Congress enacted legislation that authorized DoD to purchase major weapon systems and their components using multiyear contracts that could include purchasing items "in economic order quantities" (EOQ). Since then, the Congress has authorized multiyear contracts covering up to five years for 46 major weapon systems. Multiyear

programs. however, are still subject to annual budget reviews; each year, DoD submits budget requests for authorization and appropriation of funds for Congressionally approved multiyear programs. In a recent review of multiyear contracting for major weapon programs, the Congresssional Budget Office (CBO) has determined that, under the current budgetary process, multiyear contracts have essentially met the goals of greater stability and cost savings. 4/

As with a two-year budget, milestone budgeting could be consistent with multiyear contracting by stipulating that program reviews would occur at intervals corresponding to the length of a multiyear contract. In effect, milestone budgeting could simply be another form of multiyear contracting, possibly differing only with regard to limits on programs that could be covered. Currently, multiyear programs must be production programs that meet specific criteria identified in the law. Under milestone budgeting, all programs--including developmental programs--could be authorized for multiyear funding unless the Congress chose to establish criteria of selection for milestone programs or limited the scope of milestone funding.

Because of the similarities that exist between multiyear contracting and milestone budgeting, the experience of the former could be instructive in considering the possible effects of the latter. This study, therefore, includes a discussion of multiyear contracting performance and an assessment of the potential impact of five-year funding on the variables influencing the potential costs and benefits of milestone budgeting.

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4. Congressional Budget Office, *Alternative Strategies for Increasing Multiyear Procurement* (July 1986).

CHAPTER II

POTENTIAL GAINS FROM MILESTONE BUDGETING

If effectively carried out, milestone budgeting could introduce major improvements in the way the nation acquires weapons systems for its defense. Some advantages are general in nature. Milestone budgets could alter the incentives provided to defense program managers, causing them to focus more on program implementation rather than budget review. This approach could also garner some of the overall benefits of multiyear budgeting. Other advantages are more specific. Milestone budgeting could reduce the instability now associated with defense programs--a problem cited by many major reviews of defense procurement undertaken during the last 15 years. In turn, increased stability could lower costs. Finally, milestone budgeting could reduce the budgetary workload in the Administration and the Congress.

OVERALL ADVANTAGES

Today's managers of weapons programs must pay considerable attention to each year's funding requests. Under the current system, that attention is well-placed. As the next section of this chapter makes clear, those requests are frequently altered within both the Administration and the Congress. Nonetheless, time spent revising annual funding requests takes away from time spent ensuring that defense dollars are spent wisely. Milestone budgeting would free defense managers to concentrate more on implementing plans. Likewise, milestone budgeting should reduce the time companies with defense contracts spend supporting annual budget requests, which could lower the cost of weapons.

More generally, milestone budgeting would garner for parts of the defense budget the advantages inherent in multiyear budgeting. It is very difficult to alter in one year the course of a major government program--whether that program provides medical care or builds weapons. Commitments have been made and designs are in place that take time to change. Thus, to set priorities and spend efficiently for defense and other government activities, the Administration and the Congress need to plan ahead for more than one year. Milestone budgeting would provide one

means for such advance budgeting. 1/ The remainder of this chapter discusses more specific advantages of using the milestone approach for weapons acquisition.

PROGRAM STABILITY

The key to successful reform in funding weapons acquisition programs lies in improving program stability. Many major reviews of defense acquisition over the past 15 years have identified program instability as a major problem. 2/ According to these studies, program instability has often resulted in reduced military capability and higher costs for weapon systems. Despite the findings of these reports, little analysis has been done to characterize and quantify program instability. The following analysis provides aggregate level measures of the incidence and genesis of program instability and suggests that milestone budgeting could afford greater program stability than currently exists.

Not all changes to weapons programs are bad. Some are needed because of technical obstacles or changes in the threat; others may delay a new program to avoid closing key production facilities for existing programs. Many changes, however, are not related to valid military requirements, including those caused by overly optimistic forecasts of cost, performance, or schedule and those caused by budgetary constraints. Thus, it is important to identify not only the frequency of program changes but also their cause. The following analysis includes both the research and development (R&D) and production phases of weapons acquisition.

Frequency of Changes

An analysis of budget data from fiscal years 1982 through 1986 shows that changes to weapons research and development programs are pervasive within the annual budget process. This analysis defines a "major change" for R&D programs as shifts in funding by greater than ten percent from the DoD planned level or from the level requested in the President's budget to the level approved by the Congress.

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1. For a discussion of advance budgeting, see Congressional Budget Office, *Advance Budgeting: A Report to the Congress* (February 1977).

2. These studies include Report of the Commission on Government Procurement (1972); Defense Resource Management Study Final Report (1979); Carlucci Initiatives (1981); Grace Commission (1984); and Packard Commission (1987).

TABLE 1. NUMBER OF MAJOR CHANGES IN RESEARCH AND DEVELOPMENT PROGRAMS, FISCAL YEARS 1982-1986

	Total Possible Changes	Total Number of Adjustments Greater than 10 Percent	Percent Adjusted
Changes from DoD Planned Budget to President's Budget (Budget Year +1)	2,466	1,900	77.0
Changes from President's Budget to Congress-Approved Budget	2,466	1,523	61.8
Changes from DoD Planned Budget to Congress-Approved Budget (Budget Year +1)	2,446	2,039	83.4

SOURCE: Department of Defense, *R-1*, 1981-1987.

Table 1 shows that, in the year between the time that DoD approved advanced plans for a particular budget and the time that the Congress approved that budget, 2,039 out of the 2,446 possible changes in R&D programs examined--or an average of 83.4 percent--experienced changes of greater than 10 percent in their funding over the 1982-1986 period. 3/ Of the 2,039 cases, 770 cases (37.8 percent) were adjusted to increase funding above the approved plan; 1,269 cases (62.2 percent) experienced reduced funding. Some of the reductions may have been caused by the lower than anticipated inflation during this period, but such decreases generally amounted only to a few percent.

While it is reasonable to attribute unstable funding for R&D programs to the many uncertainties encountered during the early stages of the acquisition process, it is less evident that production programs would experience

3. Data shown here include all weapons programs in advanced and full-scale development. Results reflect changes during the year between approval of an advanced plan (for example, the 1986 column of the 1985 budget) and actual approval of the budget (in this example, Congressional approval of the 1986 budget).

a similar degree of instability. Data indicate, however, that major changes for production programs occur nearly as frequently as for development programs. For production programs, "major changes" are defined as changes of more than 5 percent in the quantity of items procured from the DoD plan to the budget approved by the Congress. Table 2 indicates that, during the 1982-1986 period, major changes in production quantities occurred an average of 66 percent of the time. The incidence of major changes in recent years varied from 71.4 percent in 1984 to 60 percent in 1985 to 65 percent in 1986.

Both DoD and the Congress have introduced a significant degree of funding instability for production programs in the budget process. As indicated in Table 2, from 1982 through 1986, DoD adjusted production quantities from planned levels by more than five percent for 268 out of 443 cases, or 60.5 percent. During the same period, the Congress changed production quantities from the President's budget request by more than five percent for 192 out of 529 cases, or 36.3 percent.

TABLE 2. NUMBER OF MAJOR CHANGES IN WEAPONS PRODUCTION PROGRAMS, FISCAL YEARS 1982-1986

	Total Possible Changes	Total Number of Adjustments Greater than 10 Percent	Percent Adjusted
Changes from DoD Planned Quantity to President's Budget (Budget Year + 1)	443	268	60.5
Changes from President's Budget Quality to Congress-Approved Quantity	529	192	36.3
Changes from DoD Planned Quantity to Congress-Approved Quantity (Budget Year + 1)	341	225	66.0

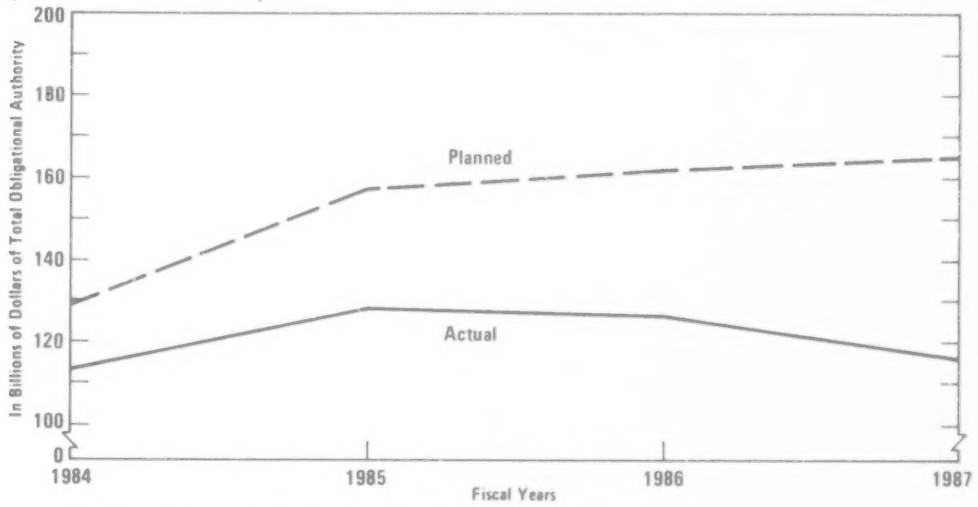
SOURCE: Congressional Research Service, *Selected Defense Procurement Acquisition Profiles: A Data Base* (June, 1986).

Causes of Major Changes

Congressional and DoD budget documents do not provide comprehensive information concerning specific causes of individual program adjustments. Consequently, a more indirect assessment is necessary. Budget reductions are one likely cause. Figure 1 compares total planned acquisition expenditures with funding authorized by the Congress from fiscal years 1984 through 1987. The "planned" line represents budget levels planned each year by DoD for the following budget year. The "actual" line indicates the budget authority approved by the Congress for the year corresponding to the plan.

For both R&D and production programs, actual budget authority was lower than planned levels over the 1984-1987 period. The disparity between planned versus actual was greater for production than for R&D. The Congress authorized $114.1 billion less for procurement (24.3 percent) and $14.9 billion less for R&D (10.5 percent) than DoD planned during this period. Clearly, these budget cuts led to program instability.

Figure 1.
DoD Weapons Acquisition Budget
(Planned Versus Actual)



SOURCE: Department of Defense, *R-1 and P-1*, 1983-1987.

An alternative means of assessing the causes of program instability is provided by the *Selected Acquisition Reports* (SARs) to the Congress. 4/ According to the September 1986 SARs, which reviewed 100 major weapons programs, quantity changes from the DoD plan produced the greatest proportion of cost increases above program baselines--about 63 percent. A variety of causes may have generated such changes, including those in program requirements as well as lower production rates resulting from budgetary constraints.

The SARs also identify the cost of technical (engineering) changes to programs that were needed to meet program performance objectives. According to the September 1986 SARs, only 16.6 percent of the cost increases above program baselines were explained by engineering changes. The SAR data suggest that unanticipated costs of purely technical changes have been greatly exceeded by nontechnical adjustments to program quantities.

Can Milestone Budgeting Reduce Instability?

It seems likely that milestone budgeting would result in fewer program changes. Since milestone budgeting would constitute a form of multiyear funding, the stable performance of multiyear production programs provides evidence of the potential effectiveness of a milestone budgeting approach. Of the 46 multiyear contract programs approved by the Congress since 1982, only one has been cancelled because of a change in requirements (M-60 Thermal Sight) and one contract was not awarded (M-9 Armored Combat Earthmover). Moreover, over the entire period of each multiyear contract, planned quantities have been approved for all multiyear programs except for minor adjustments to the C-2 aircraft and MK 45 gun mount contracts.

The relative stability of multiyear contract programs does not guarantee equal success for milestone programs. First, multiyear contracts are limited to weapons production programs and constitute only about 6.4 percent (in total obligational authority) of all defense procurement in 1987. Second, multiyear programs must fulfill special legal requirements for stable design, funding, and military need that not all production programs may be able to meet. Nonetheless, the success of multiyear contracting is

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4. In the SARs, DoD analyzes changes to program costs from baseline estimates. A variety of factors account for the changes, including those related to adjustments to quantities, schedules, and engineering. The SARs also estimate changes in cost stemming from economic factors, including inflation and estimating as well as changes to support requirements or related to management.

an encouraging indicator that greater stability is achievable through a multiyear budgeting approach.

The key to reducing instability lies in implementing management policies that are subsumed under a milestone budgeting approach. One such policy is program "baselining," an initiative recommended by the Packard Commission and incorporated into the 1987 Defense Authorization Act. A program baseline consists of a set of thresholds for requirements, costs, schedules, and performance that are established at an acquisition milestone. Under milestone budgeting, multiyear funding would be based on program baseline estimates, and could not be adjusted during a milestone period unless baseline thresholds were breached and revised baselines were approved.

The incentives underlying such an approach favor establishing more conservative program objectives--a consistent goal among those seeking greater program stability and more realistic budgets. Overly optimistic program estimates have contributed to program instability in the past since, in many cases, they were never achievable. The current law requires any deviation from a program baseline to be reported and a program review to be conducted by DoD to determine appropriate management actions. A conservative baseline estimate, therefore, would minimize the risk that such actions would be needed. The incentive toward more conservative program thresholds would be increased by tying multiyear funding to baseline estimates and by requiring a program review by the Congress in the event that a baseline threshold was breached.

Milestone budgeting would also create an incentive to avoid program changes that cause departures from baseline estimates. The requirement to report deviations from a program baseline, for example, would serve as an important incentive to maintain the program baseline if at all possible. Related policies, such as that adopted by the Air Force which requires a consensus among upper management before a major program change can be approved, reinforce a more conservative approach toward approving proposals for program changes.

SAVINGS

Milestone budgeting could achieve significant savings by improving program stability. Because milestone budgeting would constitute a major departure from the traditional budget process, no firm data exist with which to estimate the value of its potential benefits with confidence. Certain data, however, suggest possible savings.

TABLE 3. ESTIMATED ADDITIONAL COSTS OF WEAPONS SYSTEMS RESULTING FROM PROGRAM STRETCHOUTS

Source	Number of Program Stretchouts	Total Program Cost Increase (In millions of dollars of budget authority)
1981 SAR	22	3,939
1982 SAR	20	5,615
1983 SAR	17	2,402
1984 SAR	40	3,957
Total	99	15,913
Average per Year	25	3,978

SOURCE: Congressional Budget Office, based on Department of Defense, *Selected Acquisition Reports* (various years).

Savings generated through multiyear contracting represent one such measure. Based on a review of the 40 multiyear contracts approved from 1982 through 1986, DoD data suggest savings averaging 11.7 percent from the costs of procuring the same items on an annual basis. 5/ Most of these savings have been achieved through "economic order quantity" (EOQ) purchasing, a contracting technique that saves money through purchasing large lots. Milestone budgeting could achieve similar savings if EOQ purchasing were used and milestone programs remained stable.

Another possible measure of potential savings under milestone budgeting is the costs that could be avoided by refraining from slowing or stretching out programs. Such savings could be significant. The CBO, for example, has estimated that from 1981 through 1984 an average of $4 billion in budget authority was added each year to total program costs for stretched-out production programs (see Table 3). These estimated additional costs assume the purchase of the same total number of weapons, but at reduced production rates over a longer period of time.

5. Congressional Budget Office, *Alternative Strategies for Increasing Multiyear Procurement*, (July 1986), p. 17.

These aggregate estimates of stretch-out costs are borne out by estimates for individual weapons. The CBO examined a number of major programs that were stretched out from planned production levels during the 1983-1987 period. As a result of stretchouts, production unit cost increases among the sample programs varied from 2.6 percent for the Stinger missile to 48.2 percent for the Patriot missile. Moreover, stretchouts also resulted in reduced military capability since fewer systems were purchased. Some examples of the costs of stretching out a program are illustrated in Table 4.

TABLE 4. COSTS OF PRODUCTION STRETCHOUTS, FISCAL YEARS 1983-1987

System	Total 1983-1987 Quantity	Total 1983-1987 Cost (In millions of fiscal year 1983 dollars)	Procurement Unit Cost (In millions of fiscal year 1982 dollars)
F/A 18			
Planned	552	11,772.0	21.3
Actual	420	10,367.8	24.7
SH-60B			
Planned	186	2,828.3	15.2
Actual	107	1,834.5	17.1
Sparrow			
Planned	13,705	1,690.7	0.12
Actual	10,099	1,539.8	0.15
Patriot			
Planned	3,742	4,064.9	1.09
Actual	2,427	3,906.7	1.61
F-15			
Planned	390	10,204.0	26.2
Actual	207	7,124.4	34.4

SOURCE: Congressional Budget Office.

BUDGET REVIEW WORKLOAD

In addition to achieving cost savings and improved program management, milestone budgeting could potentially reduce the budget review workload below current levels for both the Congress and the DoD. In the short run, the workload could actually increase, since the Congress and DoD might spend more time assembling and assessing budgets for milestone programs in addition to conducting the normal annual budget review for other programs. The following analysis suggests, however, that milestone budgeting could ultimately reduce the number of systems subject to review each year.

Table 5 uses data from the December 1985 SARs to suggest the reductions in the number of programs subject to review under various milestone

TABLE 5. CONGRESSIONAL WORKLOAD FOR R&D AND PRODUCTION PHASES, UNDER TWO MILESTONE BUDGETING OPTIONS (By fiscal year)

Option	Program Reviews in 1986	Percent of Baseline in 1986	Program Reviews in 1976-1987	Percent of Baseline in 1976-1987
	Research and Development Phase			
Number in Baseline (Actual)	65	100.0	483	100.0
Two-Year Option	39	60.0	260	53.8
Five-Year Option	17	26.2	127	26.3
	Production Phase			
Number in Baseline (Actual)	62	100.0	382	100.0
Two-Year Option	38	61.3	206	53.9
Five-Year Option	13	21.0	103	27.0

SOURCE: Congressional Budget Office, based on Department of Defense, *Selected Acquisition Reports* (December 1985).

budgeting options. The baseline figures give the total number of budget reviews for individual SAR programs conducted in 1986 and during the period from 1976 through 1987. Program reviews for a two-year milestone budgeting option--that is, based on actual milestone occurrences and milestone funding for two-year increments thereafter--would have occurred about half as often as the baseline number of annual reviews. Figures for a five-year option--that is funding for five years or the full time required to reach the next milestones, whichever comes first--show roughly a 75 percent reduction in the number of reviews that would have occurred. Workload reduction estimates are similar for both research and development and production programs. Both assume no revisiting of programs that have received milestone budget status.

In theory, if the budget review focused on fewer programs each year, the quality of individual program reviews could improve. The opportunity would exist to examine programs in greater depth on milestone review occasions or when a baseline threshold was breached. On the other hand, the potential would also exist for unnecessary adjustments to the technical details of a program. Such intrusiveness could be an obstacle to the success of milestone budgeting if it generated additional program instability.

The potential for workload reduction could be significantly affected if milestone funding were authorized but not appropriated by the Congress. Under the current DoD interpretation of the milestone budgeting test mandated by the 1987 Defense Authorization Act, workload reduction would occur only with respect to the authorization process. Preparation and review of program budgets will still be required on an annual basis for the appropriation phase of the budget process.

CHAPTER III

POTENTIAL PROBLEMS UNDER MILESTONE BUDGETING

Along with important advantages, milestone budgeting could present some potential problems. If milestone budgeting worked as intended, portions of the budget would be exempt from review and adjustment each year; this inflexibility could be troublesome if the deficit or other constraints forced reductions in the defense budget. In these circumstances, cuts would have to be levied disproportionately on nonmilestone programs since the Congress would have already committed funding to milestone programs.

Milestone authorizations or appropriations for major weapon systems could also, under some approaches, introduce major year-to-year variations in defense budget authority. This variability could be a problem in overall reviews of defense budgets, which often focus on real growth from year to year. Both these problems, however, could be minimized by careful management of a milestone budgeting system.

BUDGET INFLEXIBILITY

Under milestone budgeting, portions of the defense budget would automatically be allocated each year to systems that did not have a milestone or were not scheduled to be reviewed by the Congress during that year. If the portions of the defense budget exempt from review were large and substantial budget reductions were required, these exemptions could result in disproportionate reductions in nonmilestone programs or in those milestone programs subject to review in that particular year.

Theoretically, of course, programs under milestone budgeting could still be altered by the Congress, even if they were between milestones, since the Congress could always pass a law changing previous decisions. Even signed contracts could be abrogated, though perhaps at substantial cost. If, however, the Congress adhered to the milestone approach, it would not alter past decisions, and, therefore, budget inflexibility could be a problem--perhaps an important one if recent history is a guide. Even in recent years when the defense budget was increasing, Congressional and DoD personnel have expressed concern that budget stabilizing measures would unnecessarily restrict their freedom to make program and budgetary adjustments. The

reticence of DoD to expand the use of multiyear contracts and of the Congress to fund a number of multiyear candidates reflects their mutual concern over losing budget flexibility.

Degree of Inflexibility

The extent of inflexibility would depend on how many programs were subject to milestone budgeting; the broader its scope, the greater the potential problem. The potential loss of flexibility would also depend on whether milestone budgeting applied only to authorizations, which would allow a program to go forward but provide no funding, or to both the authorizations and appropriations of funds.

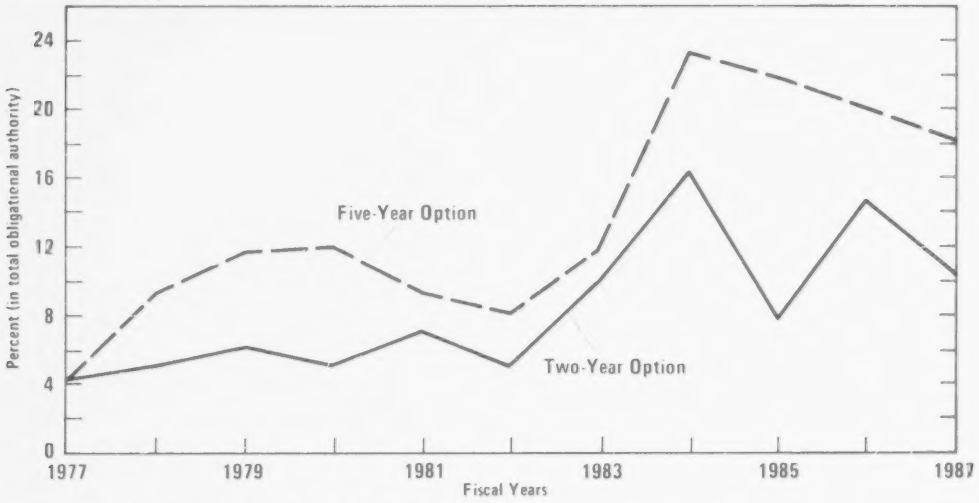
Based on major programs in the December 1985 *Selected Acquisition Reports* (SARs) and assuming both authorizations and appropriations of milestone budgets, Figure 2 shows the percentage of research and development funding that would have been exempt from review during the 1976-1987 period under two milestone budgeting alternatives: one with reviews every two years and one with five-year reviews. 1/ The level of funding exempt from review would have increased over time as more programs entered the milestone budgeting system, which suggests the effects of phasing in milestone budgeting. Under the five-year scheme, for example, the portions of the R&D budget exempt from review would have increased from 4 percent in 1977 to about 23 percent in 1984 and then have declined slightly to about 18 percent in 1987 as the R&D phases of some programs were completed.

Stated in another way, while milestone budgeting for development programs would, under these assumptions, have resulted in an increasing loss of overall budget flexibility, it would still have permitted considerable leeway to make adjustments within the R&D appropriation. Even under the most restrictive case of the five-year option, milestone budgeting would have permitted the review of 77 percent of the R&D budget.

Similar trends for production programs are illustrated in Figure 3, although the absolute levels of exemption are much higher than for develop-

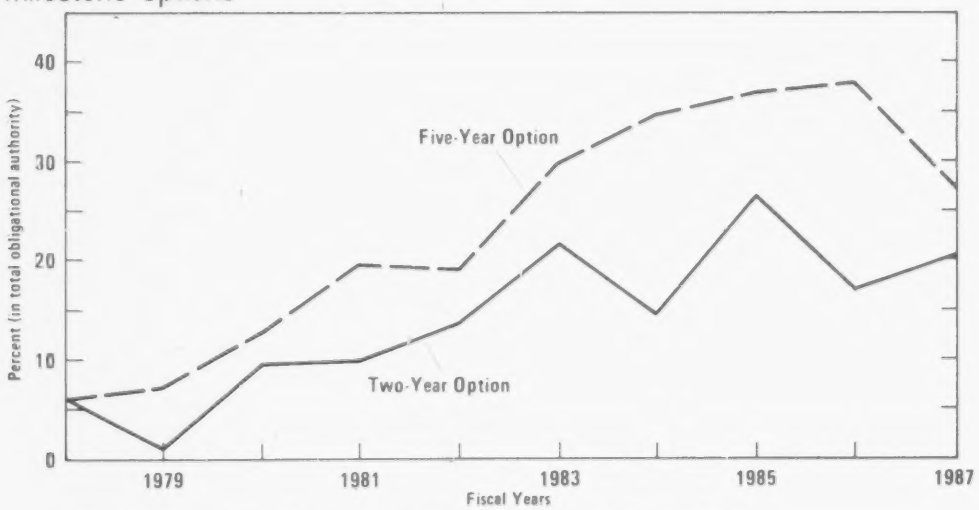
1. The two approaches to milestone budgeting are applied to SAR programs for full-scale development (FSD) and production milestones to determine the loss of budget flexibility that could have occurred during the 1976-1986 period. Major programs were assumed to be funded annually until their actual FSD and production milestones occurred; they were budgeted only on a milestone basis thereafter. Major programs not included in the December 1985 SAR and nonmajor programs were assumed to be reviewed annually.

Figure 2.
Percent of R&D Budget Exempt from Review Under Two Milestone Options



SOURCE: Department of Defense, *Selected Acquisition Reports* (December 1985).

Figure 3.
Percent of DoD Production Budget Exempt from Review Under Two Milestone Options



SOURCE: Department of Defense, *Selected Acquisition Reports* (December 1985).

ment programs. The maximum level of funding exempt from review would have varied from 26 percent for the two-year option in 1985 to 38 percent for the five-year option in 1986. This most restrictive case would still have permitted the review of 62 percent of the production budget.

The analysis is based on historical program behavior and budget data, and makes no allowance for the possibility that individual programs and the overall budget might have been managed differently under a milestone system. There is no reliable way to predict the changes that might have occurred under a milestone budgeting system and to adjust the results of the analysis accordingly. Despite this important limitation, the results illustrate the potential loss of budget flexibility that milestone budgeting might portend.

It seems clear that reduced flexibility is the most important concern among those persons considering any form of multiyear budgeting, including milestone budgeting. The degree of inflexibility can always be adjusted to tolerable levels, however, by reducing the number of weapons systems covered by milestone budgeting. Thus, careful management would have to balance the stability gains from milestone budgeting against the potential loss in flexibility in deciding the scope of the milestone approach.

BUDGET VARIABILITY

In the interest of achieving greater program stability, milestone budgeting could also introduce variability in defense budget authority. Budget variability is defined as year-to-year variations in the defense budget authority that could be introduced if the Congress were to grant approval in a single year for multiple years' funding for production of a major weapons system. Potentially large perturbations in funding could complicate the debate over the total defense budget, since that debate often revolves around the real growth of budget authority from one year to the next and growth rates could be skewed by milestone funding for several large systems at once. Large variations in a particular year could also adversely affect other, smaller programs subject to review in that year as their funding was cut in order to accommodate the budgetary demands of milestone programs.

Budget variability is probably not as important a problem as inflexibility. It would apply mainly to budget authority, since outlays from weapons programs depend on the pace of manufacturing rather than when money is appropriated. Moreover, increased variation in budget authority could be avoided by the management practices discussed below. Nonetheless, given the importance of real growth as a measure in the annual debate over the

defense budget, the possibility of increased budget variability cannot be ignored entirely.

Degree of Variability

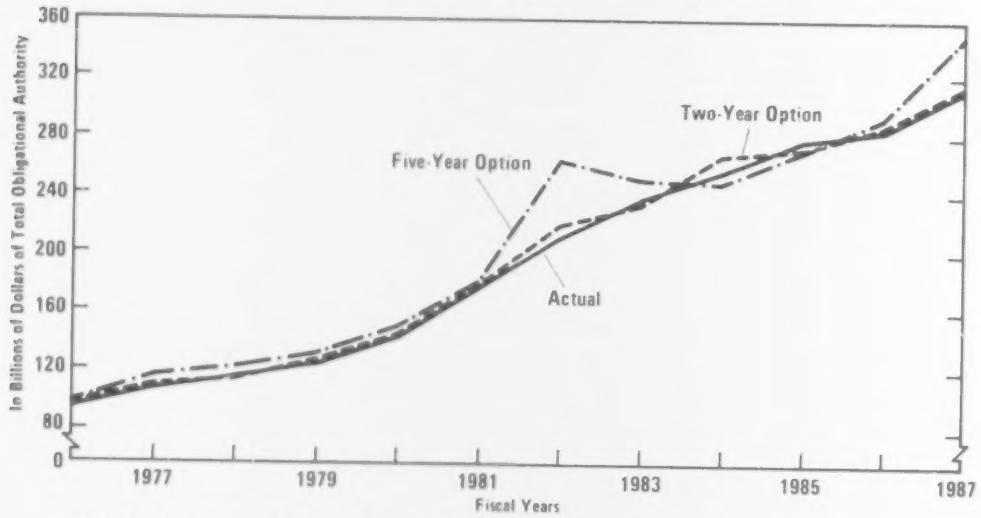
The degree of variability that milestone budgeting could introduce would depend on some of the factors previously discussed concerning budget flexibility: the number of programs subject to milestone budgeting and whether or not milestone funding was authorized, but not appropriated.

In addition, the potential to introduce variability would depend on the way in which the Congress approved funds for milestone programs. The Congress could avoid introducing budget variability if it approved in advance several years of annual funding for milestone programs. For example, the Congress could decide to provide a milestone budget for a large production program expected to cost $5 billion in budget authority over three years, but stipulate that only $1 billion could be available for obligation in the first year, $2 billion in the second, and $2 billion in the third. This approach should cause no budget variability compared with a budget based on the current annual budget process. By contrast, if the Congress were to provide funds in a lump-sum fashion--that is, all $5 billion approved in a single year to be obligated as production needs dictate--significant budget variability could result.

To assess this potential problem, CBO examined the same major programs considered above--the December 1985 SAR programs--under the same assumptions that were applied to the flexibility analysis. The following analysis, however, assumes that lump-sum funding for milestone budgeting was phased in beginning in 1976. The details of method and the milestone budgeting alternatives--two-year and five-year versions--are the same as those discussed regarding budget flexibility.

Figure 4 illustrates the changes in funding that would have occurred relative to actual budget levels during the 1976-1987 period in the total DoD budget. The five-year option would have introduced greater variance than the two-year version. The five-year option, for example, varied an average of 5.3 percent from the actual DoD budget from 1976 through 1986, while the two-year option varied by an average of 1.3 percent. The range of variation is also greater for the five-year option. The funding adjustments that would have been required to meet the two-year option would have varied from -2.2 percent from the actual funds appropriated in 1985 to +4.6 percent in 1984. Funding for the five-year option would have required an adjustment of -3.2 percent in 1984 to +25.4 percent in 1982.

Figure 4.
Total DoD Budget Variability Under Two Milestone Options



SOURCE: Department of Defense, *Selected Acquisition Reports* (December 1985).

The potential effects of lump-sum funding are less significant as a percent of the total DoD budget, since much of that budget--with more than half devoted to operating costs plus acquisition of nonmajor programs--is assumed to introduce more dramatic budget variability if viewed in the context of the R&D and production budgets separately. (See Appendix B for details.)

Clearly, given actual program behavior during the 1976-1987 period, lump-sum milestone budgeting for all SAR programs would have introduced significant budget variability compared with actual defense acquisition budgets. On the other hand, in order to minimize the potential for major fluctuations in total budget levels that could result from lump-sum funding, milestone budgeting options could be adopted that limited the number of milestone programs or minimized the period of lump-sum funding. Major fluctuations in the budget generated by milestone budgeting could also be minimized by effective strategic planning for acquiring weapon systems, based both on affordability and military priorities. A premium would be placed on determining mission area needs, establishing priorities among requirements, and achieving coordination among the armed services in these matters. Budget variability could also be minimized through the development and use of realistic program baselines and the effective management of proposals to change programs. Alternatively, the Congress could simply avoid the budget variability problem by eschewing the lump-sum approach.

CHAPTER IV

ISSUES IN FORMULATING A MILESTONE BUDGET PLAN

If the Congress should choose to establish milestone budgeting for weapons acquisition programs, it would have to decide on a number of important issues which fall into two basic categories: those concerning the scope of application of milestone budgeting and those regarding the process of implementation. This chapter considers these issues and concludes with a discussion of the current status of milestone budgeting and possible directions the Congress could take.

ISSUES OF SCOPE

The success of milestone budgeting in ensuring program stability and achieving savings and other benefits depends heavily on the scope of its application. Three major issues concerning applicability should be addressed: the number and type of programs to which milestone budgeting would apply, the acquisition milestones involved, and the length of time covered by a milestone budget.

Number and Type of Programs

In general, the greater the number of acquisition programs to which milestone budgeting is applied, the greater its potential benefits will be. On the other hand, as the analysis in Chapter III indicated, broad application of milestone budgeting could decrease budget flexibility and increase budget variability, perhaps beyond acceptable levels. Ultimately, a plan for milestone budgeting should try to maximize net benefits while minimizing potential costs. The number of programs using this approach is a critical variable in achieving this goal. The following discussion outlines possible alternatives for selecting the number of programs to be covered.

One option would apply milestone budgeting to all programs that the Department of Defense defines as "major." Major acquisition programs are designated by the Secretary of Defense and are reviewed at acquisition milestones by the Defense Acquisition Board (DAB). Programs are usually designated as major if they exceed $200 million in research and development

funds or $1 billion in production funds (both in 1980 dollars). Joint service programs or international cooperative programs may also be designated as major. 1/ Currently, 53 major programs are subject to milestone review by the DAB (see Appendix B). Historically, these major programs account for about half of all defense procurement funds and 15 percent of the R&D budget each year.

Applying milestone budgeting to all major programs managed by the DAB should yield costs, benefits, and risks similar to those outlined in Chapters II and III. Thus, for example, the number of program changes could be significantly reduced, but there would also be less flexibility to modify the budget in response to changes in fiscal policy.

Alternatively, milestone budgeting could be applied only to high-priority, major programs based on criteria set by the Administration and reviewed by the Congress. While this approach could reduce the benefits, it could also substantially reduce the risks of milestone budgeting. For example, milestone budgeting could be limited to those programs that meet two tests: reasonable agreement within the military services about system requirements and relatively low risk of expensive technical problems. A third criterion--limiting the milestone approach to smaller major programs--could be added if the Administration or the Congress were concerned about less budget flexibility caused by putting large, major programs off limits during periods of budget reductions.

Rather than limiting the number of programs to be managed under milestone budgeting, last year's legislation establishing a test of milestone budgeting implied that the Congress might eventually apply it to all defense programs whether major or minor. Universal application of milestone budgeting might offer greater potential benefits than a program limited to major programs, but it would also create significant problems. Today DoD manages about 2,000 programs on a milestone basis. 2/ Placing all these programs under milestone budgeting would greatly increase the difficulty of managing the Congressional workload. It might also require significant changes in current DoD practices, since many minor programs consist of a number of projects that are each managed according to different milestone schedules. If the Congress wished to extend the benefits of milestone bud-

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1. Some weapon programs that exceed the normal thresholds of major program costs are not designated as major and are not managed through the DAB acquisition milestone process. Typically, these have included major ship types and classified programs.

2. These include about 160 major programs and 1,840 minor programs.

geting beyond major programs managed by the DAB, it would probably be most sensible to select only a few of the minor programs that are felt to be of high priority rather than to attempt to apply milestone budgeting universally.

Selection of Milestones

In addition to deciding which programs to cover under milestone budgeting, the Congress must also consider which milestones to include under this new procedure. Milestone budgeting could apply to all major acquisition milestones beginning with the approval of a new program through the authorization of full production. The choice may depend on the risks and benefits at each milestone.

Early Acquisition Milestones (Milestones 0 and I). The two early milestones in the life of a weapons system are the approval of a justification for the start of a program (Milestone 0) and approval of funds to demonstrate and validate the technological concept for an approved system (Milestone I). The risks associated with milestone budgeting for these early stages are modest. In general, it is unlikely that, under a milestone budgeting approach, programs would breach baseline thresholds during these early acquisition stages. The first acquisition phase is essentially a stage in which program plans are established and paper studies of system feasibility are conducted. Contractors can usually adhere to funding limits and schedules during this initial acquisition phase.

The risk that a program might breach a baseline threshold is higher following Milestone I, however, than for the initial concept exploration phase following Milestone 0. Efforts to demonstrate the concept for a weapons system following Milestone I often necessitate building experimental prototypes. Particularly for high technology systems, technical problems, both foreseen and unanticipated, are initially encountered during this process. Such problems, if significant, might generate cost and schedule threshold breaches that would require revision of a program baseline.

Budget reductions to infant programs also generate changes and delays that could breach baseline thresholds. Milestone budgeting could avoid such problems at relatively low cost by ensuring budget stability during these initial acquisition phases. Since program costs for infant programs are relatively small, milestone budgeting would not significantly restrict Congressional flexibility to make other budgetary adjustments within the R&D appropriations.

Full-Scale Development (Milestone II). After a program demonstrates that its requirements, technology, and system concept are valid, it may be approved for full-scale development at Milestone II. During this stage, a contractor builds and tests a prototype of the system. The Packard Commission endorsed milestone budgeting for use during this critical acquisition phase.

During full-scale development, the potential benefits of milestone budgeting are substantial. This stage usually lasts about five years for major weapons and involves significant expenditures. Program delays because of funding reductions, which the analysis in Chapter II suggests are common, result in added costs and adverse effects on military capability. These adverse effects are important because, by the time of full-scale development, the weapons systems are anticipated in DoD's force planning.

The potential costs of milestone budgeting used during full-scale development, however, can also be significant. Program costs are usually much greater for full-scale development than for earlier acquisition phases and could restrict budget flexiblity to a greater degree, particularly if many full-scale development programs are under milestone budgeting. For example, full-scale development of the C-17 is estimated to cost about $2.7 billion, while the pre-Milestone II costs totaled about $200 million (both in fiscal year 1981 dollars).

Substantial technical risks to baseline thresholds also exist during full-scale development. Indeed, the risk that thresholds may be breached is probably greatest during this acquisition phase when a working prototype must be built. If technical problems develop, then milestone budgets may have to be revised and program stability could be lost. Technical risks may be particularly great if programs proceed directly from Milestone 0 to Milestone II without demonstrating and validating a system concept.

Steps have been taken in recent years, however, to reduce cost and technical risks during full-scale development. For example, the fiscal year 1984 Defense Authorization Act requires that DoD complete an independent cost estimate--that is, one done by cost experts who have no involvement in the project--before a program can be authorized to enter full-scale development. Also, recent DoD acquisition policy encourages early prototype production and testing to reduce program risk during full-scale development. Milestone budgeting would reinforce the thrust of these policies by providing an incentive to establish low-risk projections as baseline estimates.

Production (Milestone III). Weapons systems are approved for production at Milestone III. For some systems, this approval takes place in two steps:

approval of initial, low-rate production (Milestone IIIA) and approval of full-rate production (Milestone IIIB). The Packard Commission endorsed the use of milestone budgeting for both stages. 3/

The potential benefits of milestone budgeting may be most visible during production. Delays are common at this stage, often because of budget limits. CBO recently reviewed the production of 40 major weapons systems. 4/ Compared with plans established in 1983, production from 1983 through 1987 averaged about 85 percent of plans and, for many systems, amounted to two-thirds or less of plans. These slowdowns or "stretchouts" of production occurred even though funding for the Department of Defense increased in real terms during three of the five years from 1983 through 1987. If milestone budgeting could avoid such stretchouts, systems would be available sooner and cost less per unit.

On the other hand, the problems associated with milestone budgeting for systems in production could be substantial. Costs are large, which means that flexibility to adjust budgets could be significantly impaired. For example, if a milestone budget had been authorized for full-scale development of the F-16 from 1975 through 1979, the Congress would have authorized $828 million; a milestone authorization for a similar period for initial production of this system (1977 through 1981) would have cost $6.6 billion.

Moreover, significant technological risks may exist for programs even though they are in production. For many, if not most programs, initial production begins before the testing of a system is complete. As a result, technical problems often arise that may require major adjustments in production or even in design. These risks are particularly evident for systems entering initial production (Milestone IIIA). Generally, weapons systems that enter full-rate production (Milestone IIIB) have experienced a greater degree of testing.

Moreover, program risk has also been reduced through a number of acquisition policies recently implemented. For example, the fiscal year

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3. The Packard Commission endorsed milestone budgeting for initial production as a part of the Milestone II decision.

4. Statement by Robert F. Hale, Assistant Director, Congressional Budget Office, before the Senate Armed Services Committee, Subcommittee on Conventional Forces and Alliance Defense and Subcommittee on Defense Industry and Technology, March 17, 1987.

1984 Defense Authorization Act prescribes that the Director of Operational Test and Evaluation must certify to the Congress that a system has successfully passed operational testing (during which systems off assembly lines are tested by officer and enlisted personnel under normal operating conditions) before full production can be authorized. In addition, for major programs managed at the service level, full production cannot be authorized unless program baseline objectives established at Milestone II have been met.

Whether to apply milestone budgeting at a particular milestone--I, II, or III--requires weighing of risks and benefits that vary at each stage and for each weapons system. Thus, the Congress may wish to make milestone budgeting available for all milestones and then decide which programs to include based on the characteristics of the individual system.

Period of a Milestone Budget

Yet another of the choices in specifying a system of milestone budgeting concerns the period covered by the budget. The Congress could approve a program at its milestone and provide funds intended to last until the next milestone or the completion of production. Alternatively, the Congress could approve a program at one milestone but provide funds only for a certain number of years. One version of this approach would provide funds for two years, consistent with the two-year budgeting approach that the DoD has proposed for its entire budget.

In general, the longer the period of coverage, the greater the potential benefits but also the greater the potential problems. Ensuring budget stability for an extended period can both generate savings through management efficiencies and avoid costs associated with program changes. In addition, the workload accompanying project reviews--both in the Administration and in the Congress--is less the longer the period of the milestone budget, as the analysis in Chapter II demonstrates.

On the other hand, a long period of coverage could mean that more dollars went to programs not subject to review in a particular year which would limit flexibility to alter budgets. For example, the analysis in Chapter III points out that, under the most restrictive circumstances of a five-year milestone budgeting system applied to all major programs, about 60 percent of the procurement budget and 75 percent of the research budget would be subject to change in a particular year. With two-year milestone budgets that same system would leave 75 percent and 85 percent, respectively, subject to change.

Longer periods for milestone budgeting could also exacerbate the problem of budget variability if a lump-sum funding approach were adopted. The longer the milestone period, the greater the single-time funding required. Analysis contained in Chapter III illustrates the degree of possible variation and demonstrates that five-year milestone budgeting coupled with lump-sum funding could cause substantial variation from budgets that change incrementally from one year to the next.

Finally, programs are more likely to exceed projected budgets or other thresholds under a milestone process with long periods. This result would be particularly true for high-technology programs or for those in full-scale development or early stages of production. Therefore, as with the choice of milestones to be covered, the Congress may want to approve the concept of milestone budgeting and then choose the period of the milestone budget based on the characteristics of individual systems.

ISSUES OF PROCESS

The Congress must decide not only the scope of any milestone budgeting process, but also how to implement the process itself. Major issues concern whether budgets should be authorized only or authorized and appropriated, and whether multiyear funding should be approved in one lump sum or allocated in annual amounts. The rapidity of the transition to a milestone system, the timing of events within a new budget process, and information requirements are also issues that would require close attention and coordination.

Authorization and Appropriation

The Congress must decide whether milestone budgets should be only authorized or whether they should be both authorized and appropriated. In its current two-step process for dealing with the details of the defense budget, the Congress first authorizes defense spending (thus setting overall defense policy and limits on how many weapons can be bought) and then appropriates funds (actually making available the money to carry out the policy). Maximum benefits of milestone budgeting would be gained if both authorization and appropriation of funds were accomplished on a milestone basis. Under this approach, funding stability would be assured since program managers would have both the policy direction and the funds to proceed with a program during the milestone period. Moreover, the workload involved in program reviews would be reduced to the maximum extent possible.

On the other hand, the authorizing committees have shown the greaest interest in milestone budgeting; it was initially proposed by the Senate Armed Services Committee. Traditionally, the appropriating committees have been reluctant to appropriate funds for more than one year (although they have done so--to a limited extent--under multiyear contracting). Thus, it is possible that programs could receive milestone authorizations but still be subject to annual appropriations. This would increase the likelihood that annual program changes would continue to occur.

To assess the probability of program changes, CBO examined budget data for the period from 1982 through 1987 to determine how often significant adjustments from authorized levels were made during the appropriation process. For a sample of 344 opportunities for change to major R&D programs, appropriated funds differed from authorized amounts by greater than 10 percent in 78 cases (22.7 percent). Adjustments occurred with increasing frequency during the 1985-1987 period; 13.3 percent of major R&D programs were adjusted in 1985, 20.3 percent in 1986, and 34.7 percent in 1987. These data suggest that a significant risk exists that major R&D programs authorized for milestone funding would continue to experience adjustments during annual appropriation reviews.

Other budget data indicate that the risk of changes may be only slightly lower for production programs. Appropriated funds for a sample of 339 opportunities for change to production programs differed from authorized levels by greater than 10 percent in 70 cases (20.6 percent) from 1982 through 1987. The trend in the frequency of adjustment for production programs during the 1985-1987 period has been downward. Adjustments occurred in 22.2 percent of the cases in 1985; 21.2 percent in 1986; and 14.9 percent in 1987. Nevertheless, these percentages still suggest that there is a significant risk that budget adjustments that could compromise program stability could occur if appropriation reviews continue to be conducted annually.

One way to reduce the risk would be to limit the scope of milestone budgets to the largest acquisition programs. A review of budget data for the 20 most expensive R&D programs indicates that authorized funds were adjusted by greater than 10 percent in 18 of 105 opportunities for change (17.1 percent) during the 1982-1987 period. This result is modestly lower than the 22.7 percent of cases that received budget adjustments for the larger sample of major R&D programs. Moreover, the 15 most expensive production programs were adjusted significantly less frequently during the 1982-1987 period than the larger sample of major programs. Authorized funds were adjusted by greater than 10 percent for the 15 programs in 7 of 77 cases (9.1 percent) compared with 20.7 percent for the larger sample.

It is possible, of course, that programs could be authorized for the period of their milestones, but appropriated annually, and still avoid the substantial numbers of changes suggested by this historical data. The appropriation committees might be less likely to alter programs that have received a long-term authorization under a milestone approach, especially if there were relatively few programs under milestone budgets. But, if milestone budgeting is applied to a large number of DoD programs, and if history is a guide, authorization without appropriation might not achieve the desired program stability. Thus, this decision may be the most important among those the Congress must make if it chooses to implement milestone budgeting.

Manner of Funding

The Congress must also decide whether to provide funding for milestone programs on a lump-sum or annual basis. Lump-sum funding would maximize management flexibility and so might give DoD the greatest chance to administer programs effectively. But it could also increase the variability of budgets if several large programs received lump sums in one year. Chapter III analyzed the degree of potential variability, concluding that it could be substantial, especially under the five-year version of milestone budgeting. If the Congress elected lump-sum funding, it could also "squeeze" funding for programs not under milestone budgeting if efforts were made to reduce budget variability by cutting funds for nonmilestone programs.

Timing and Information

The Department of Defense may have to revise the timing of its milestone reviews under a program of milestone budgeting. Currently, milestone reviews in DoD proceed independently of the budget cycle. For example, DoD's budget process might approve a request for funds for full-scale development before, or after, the Milestone II review that approves full-scale development. Of course, budget approval and milestone approval must both be completed before any contracts are executed. But DoD probably would have to complete its milestone review of a program before the Congressional review leading to a milestone budget, since the data and recommendations made by the department would presumably be the basis for Congressional action. This would probably not present problems for most programs, although some schedules might have to be revised to avoid waiting months for the Congressional milestone review.

Similarly, DoD may have to provide the Congress with additional information about milestone programs. DoD already provides (with in documents such as the *Selected Acquisition Reports*) considerable detail on year-by-year costs and schedules for major programs. If, however, the Congress decided to link approval of milestone budgets to selected performance projections--for example, development of an aircraft with certain speeds or ranges--then additional data on specific performance projections might be needed. In addition, if the Congress decided that some nonmajor programs were to be included under milestone budgets, it might require additional data on cost, schedule, and performance projections.

Transition

If the Congress decides to carry out milestone budgeting and resolves the issues of scope and process discussed above, it must decide how quickly to move toward milestone budgeting. The most gradual approach to the transition would be to apply milestone budgeting to new programs as they reach applicable milestones. Restricting milestone budgeting to new programs would establish a clear set of management and oversight expectations at the outset of a program's acquisition process. In addition, this approach would involve minimal near-term budgetary commitment and loss of budgetary flexibility.

A more rapid transition could be obtained by applying milestone budgeting to existing programs as they reach applicable acquisition milestones. This approach would probably require larger near-term budget commitment and greater loss of budget flexibility than milestone budgeting restricted to new programs. On the other hand, it would be consistent with the Defense Enterprise Program test recently legislated by the Congress, which proposed milestone authorizations for existing programs entering or already in full-scale development or production. Nor should this approach overwhelm the Congress. Assume, for example, that milestone budgeting were applied to Milestones II and III for major programs beginning in 1989. According to current schedules for major programs, DoD would request milestone budgets in 1989 for two full-scale development programs and five production programs. 5/

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5. The development programs are the Anti-Armor Weapons System and Fixed Distribution System. The production programs are NAVSTAR User Equipment, the V-22 aircraft, the Submarine Advanced Combat System, the Army Tactical Missiles System, and the Inter-Service/Agency Automated Message Processing Exchange.

The most rapid transition to milestone budgeting would be achieved by initiating milestone authorizations for all designated major or minor programs whether or not they are at a milestone. This approach would probably not be practical, however, because it could involve approving milestone budgets for hundreds of programs in the first year.

ACTION TO DATE AND FUTURE STEPS

The Congress authorized a test of milestone budgeting in the 1987 Defense Authorization Act, labeling the test programs the Defense Enterprise Programs (DEP). Defense Enterprise Programs may include "any defense acquisition programs" designated by the secretaries of the armed services for streamlined management procedures specified in the legislation. The Secretary of Defense was directed by the act to designate "not less than three Defense Enterprise Programs to be considered for milestone authorization" in conjunction with submission of the 1988-1989 DoD budget request. The designated milestone authorization candidates must either be in, or ready to enter into, full-scale engineering development or full-rate production. The legislation also directed DoD to request the Congress to authorize funds in "a single amount sufficient to carry out that stage, but not for a period in excess of five years."

The Authorization Act also required DoD to submit program baseline descriptions to the Congress for milestone candidates and, for approved milestone programs, to report program deviations from the baseline to the Congress as they occur. In the event that a program breaches a baseline threshold, the Secretary of Defense is authorized to convene a program review and to submit to the Congress a revised baseline description and program recommendations. The legislation also restricts the obligation of funds in the event that a baseline deviation is not reported to the Congress within a designated time period.

The Secretary of Defense has requested the Congress to authorize milestone budgets for three DEPs designated in the 1988-1989 budget. These include the Navy's Trident II (D-5) missile system, the Army's Mobile Subscriber Equipment (MSE) program, and the Medium Launch Vehicle (MLV) system of the Air Force.

If the Congress authorizes milestone funding for the three candidate programs, the loss of budget flexibility would be minimal since there are few programs entering the system. Moreover, DoD has requested milestone funding on an annual, rather than a lump-sum basis. Procurement funds

requested for milestone candidates total $3.5 billion for 1988, or 4.1 percent of the total procurement authorization request. Total procurement authorization requested for milestone candidates during the 1988-1992 period is $14.8 billion, or 3 percent of the procurement budget projected by DoD for the five-year period. The $1.1 billion requested for research and development of the Trident D-5 missile in 1988 represents 2.5 percent of the total R&D authorization request. The total D-5 missile R&D costs of $2.3 billion from 1988 through 1992 constitute 1.1 percent of the total R&D budget projected for the period.

The Authorization Act also required DoD to submit complete baseline descriptions of the milestone candidate programs to the Congress by June 30, 1987. Since the legislation does not require the appropriation of funds on a milestone basis, the DoD will continue to submit supporting budget documentation for milestone programs each year to meet the requirements of the annual appropriation budget review.

The 1987 Authorization Act contains no provisions for how to proceed with milestone budgeting beyond the initial test. Before the Congress decides to expand its use, however, it is essential to evaluate the test results. Since the budgets for the initial milestone programs will not be completed until the 1991-1992 budget years, an assessment of their effectiveness could wait until then. Alternatively, the Congress could continue to approve a few more programs each year for milestone budgeting while monitoring progress of the milestone system each year. During this test period, the Congress could also consider and resolve the issues of scope and process discussed in earlier sections of this chapter through hearings and additional legislation.

APPENDIXES

APPENDIX A

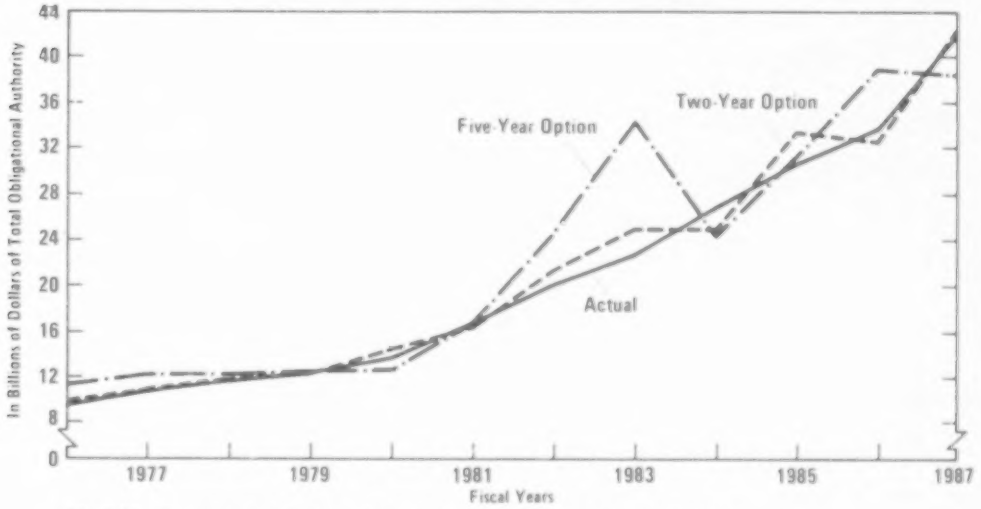
EFFECTS OF LUMP-SUM FUNDING

Under milestone budgeting, the effects of lump-sum funding are more pronounced if the research and development (R&D) and procurement budgets are examined separately. The variance is less obvious when analyzed in the context of the total Department of Defense (DoD) budget, since much of that budget--roughly half that devoted to operating costs plus nonmajor programs--is assumed to remain under annual funding.

Figures A-1 and A-2 depict the variance from actual appropriated funds for R&D and procurement that could have occurred under lump-sum funding during the fiscal years 1976-1987 period. The average variances for the two milestone budgeting options for these appropriations would exceed those of the DoD budget as a whole. For example, for the two-year option, the average variance from the actual R&D appropriation over the 1976-1987 period would be 2.4 percent; for procurement, 3.5 percent; and for the total DoD budget, 1.3 percent. For the five-year option, the level of variance would average 10.1 percent for R&D, 15.8 percent for procurement, and 5.3 percent for the total DoD budget.

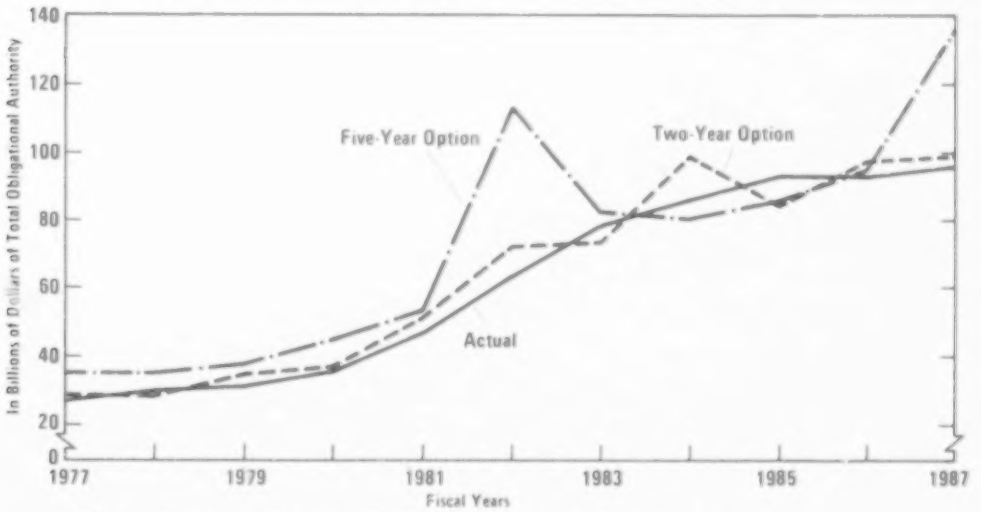
The range of variances from actual funding for R&D and procurement would also exceed those for milestone options applied to the DoD budget as a whole. For research and development, the range of variance for the two-year option would extend from -7.6 percent of actual funding to +8.5 percent and for the five-year option, from -10.7 percent to +49.6 percent. For procurement, the variance would range between -10.4 percent and +14.2 percent for the two-year option and between -9.5 percent and +77.5 percent for the five-year option. For the total DoD budget, variance for the two-year option would range from -2.2 percent to +4.6 percent; for the five-year option, from -3.2 percent to +25.4 percent.

Figure A-1.
R&D Budget Variability Under Two Milestone Options



SOURCE: Department of Defense, *Selected Acquisition Reports* (December 1985).

Figure A-2.
Production Budget Variability Under Two Milestone Options



SOURCE: Department of Defense, *Selected Acquisition Reports* (December 1985).

APPENDIX B

MAJOR WEAPONS SYSTEMS SUBJECT TO REVIEW BY DEFENSE ACQUISITION BOARD

The following list identifies the major weapons systems subject to review by the Defense Acquisition Board as of February 1987:

Advanced Target Acquisition Radar System (ATARS)
Advanced Air-to-Air Missile (AAAM)
Advanced Anti-Armor Weapons System-Heavy (AAWS-H)
Advanced Tactical Fighter (ATF)
Advanced Medium-Range Air-to-Air Missile (AMRAAM)
Advanced Anti-Armor Weapons System-Medium (AAWS-M)
Advanced Interdiction Weapons System (AIWS)
Air Defense Initiative (ADI)
Airborne Self-Protection Jammer (ASPJ)
AN/SQQ-89 Antisubmarine Warfare System
Antitactical Missile (ATM)
Armored Family Vehicles (AFV)
Army Tactical Missile System (ATACMS)
C-17 Transport Aircraft
Combat Identification System (Mark XV)
Family Medium Tactical Vehicles (FMTV)
Family Heavy Tactical Vehicles (FHTV)
Fixed Distribution System (FDS)
Forward Area Air Defense System (FAADS)
High Frequency Anti-Jammer (HFAJ)
High-Speed Anti-Radiation Missile (HARM)
Improved Strategic Communications
Integrated-Service/Agency Automated Message Processing Exchange (I-S/A AMPE)
Joint Tactical Information Distribution System (JTIDS)
LHX Helicopter
M1A1 Main Battle Tank
Medium Surface-to-Air Missile (MSAM)
Medium Launch System (MLS)
Minuteman III Penetration Aids
MK-50 Torpedo
Multiple Launch Rocket System Terminally Guided Warhead (MLRS-TGW)
NATO Anti-Air Warfare Combat System
Naval Airship

NAVSTAR User Equipment
P-3G Aircraft
Remotely Piloted Vehicle (RPV) (AQUILA)
Sea Lance (ASW/SOW)
Search and Destroy Armor (SADARM)
SH-60F (Inner-Zone Anti-Submarine Warfare Helicopter)
Short-Range Attack Missile II (SRAM II)
Single Channel Ground Air Radio System (SINCGARS)
Small Missile (SICBM)
Space Defense (ASAT)
SSN-21 Submarine
SSN-21 Combat System
Submarine Advanced Combat System (SUBACS) (AN/BSY-1)
T-45 Training Aircraft
Tacit Rainbow (Classified Program)
Trident II Missile (D-5)
V-22 (JVX) Aircraft
V-22 Aircraft (Anti-Submarine Warfare Variant)
Worldwide Airborne Command Post (WWABNCP)
Worldwide Information System (WIS)

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